ENGINEERING REPORT

for

BALL MOUNTAIN DAM

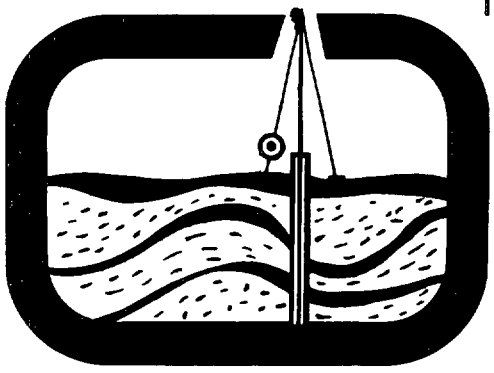
located in

JAMAICA, VERMONT

Prepared for:

U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254

31 May 1985
Contract No. DACW-33-83-D-0006
W.O. #0024



EGA

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# 1.Ø GENERAL

## 1.1 Authorization

The work described herein was performed under Contract DACW 33-83-D-ØØØ6, Work Order Number ØØ24, dated December 1984.

## 1.2 Project Site

The project site is the Ball Mountain Dam located in Jamaica, Vermont.

## 1.3 Purpose

The purpose of this work order is to install eight (8) survey crest monuments, and to monitor their vertical and horizontal movements thru April of 1985 (See Figure 1).

## 1.4 Scope of the Investigation

Installation and survey instructions, which were supplied by the Army Corps of Engineers, New England Division are included as Appendix A. No geotechnical inspection was required by the government. The installation consisted of installing eight (8) monuments along the crest at locations staked in the field by the government. The installed crest monuments were located by EDM Survey.

A total of six surveys were made to monitor vertical and horizontal movements of the crest monuments. The crest monuments are designated T1 through T8. Field data was recorded in Field Book FC 5Ø2 which was supplied by the government. Levels were run from monument B through the crest survey monuments on the dam (including old monuments G, F, and A) with a return run from the monuments on the dam back into Monument B to check the closure of the run. Closure tolerance should be no greater than Ø.Ø5'. Horizontal movements were monitored by setting up on Monument H, siting on B and recording the offset to each crest monument. The angle of the offset was recorded and the resultant distance computed. A check was made by setting up on Monument B, siting H and recording the angle and offset of each crest monument.

## 2.Ø QUALITY CONTROL

### 2.1 Monument Installation

#### 2.1.1 EQUIPMENT

The following equipment and tools were used to install the monuments:

a. Core Drill: The core drill used was a hydraulically driven rotary, head unit manufactured by Acker Drill Co. Inc. of Scranton Pa..

b. Drive Hammer: The drive hammer used to advance the casing weighed 3ØØ lbs.

c. Casing and Rods: Three inch casing was used for the installed crest monuments. AW-size drill rods were used in washing out the borehole in conjunction with a roller rock bit.

d. Drill Bits: A 2-15/16" roller bit was used to clean out the driven casing.

#### 2.1.2 Records

Records were kept of all activities and installation procedures. No boring logs were requested or kept. (See Table 1)

#### 2.1.3 Procedures

a. Two to three ft of boulders were removed from the surface prior to installing the monuments at the designated locations.

b. The monuments were installed by advancing the casing with a 3ØØ pound hammer and then washing out the casing with a roller bit.

c. The casing was then backfilled with concrete sand. The casing was sealed with a threaded cap and tightened by wrench.

d. The installed monuments were labeled in the order of their installation and were subsequently surveyed according to the specifications.

## 2.2 Survey

### 2.2.1 Equipment

The following equipment was used to determine the location and/or elevation of the crest monuments:

1. TOPCON GTS-2 total station: this instrument uses an EDM to measure slope distance and a 5 second theodolite to measure horizontal and vertical angles.

2. Wild Level.

3. Fifteen (15) feet Frisco Road.

4. TOPCON retro-prism with tilting prism holder.

### 2.2.2 RECORDS

All field data was recorded in Field Book FC502, and has been returned to the Corps of Engineers.

### 2.2.3 PROCEDURES

Each crest monument was located by setting up the EDM over Monument H, backsiting Monument B and measuring angles and distance. The EDM was then moved to Monument B, and the same procedure followed, using Monument H as a backsite.

The elevation of each crest monument was determined by precision leveling. Closure tolerance was less than 0.05 feet.

The coordinates for each crest monument were determined by arbitrarily assigning the coordinates values of 10,000, 10,000 to Monument B. The coordinates of Monument H were determined by assuming a bearing of S 30 W from Monument B to H and measuring a distance of 1257.1955. The resulting coordinates of H are 8911.2367 and 9371.4022. Using this frame of reference, the coordinates and elevation of each monument for each site visit were computed and are summarized in Appendix B.

The difference between the initial coordinates values and elevation determined during our December, 1984 visit, and each subsequent visit are summarized in Table 2 and Figure 2. The values are in feet and are not cummulative.

Found
T1
T3

## 3.0 QUALITY CONTROL CERTIFICATION

I hereby certify that the above-mentioned records, equipment and procedures were used to perform the subsurface exploration and survey work described herein. I also certify that the work was performed in a professional manner and meets the requirments set forth in the work order.

Certified May 31, 1985,

Nicholas A. Lanney, P.E.

**TABLE 1**

**SUMMARY OF SURVEY ACTIVITIES**

| DATE | ACTIVITIES |
|---|---|
| December 9 | Installed T1, T2, T3, T4. 1.5 hours standby time for moving between holes. On site for 6.5 hours. |
| December 10 | Installed T5, T6, T7, and T8. 1.5 hours standby time for moving between holes. On site for 6.0 hours. |
| December 17 | Travel to Ball Mountain Dam. Compacted additional material around loose crest monuments to secure them. Labeled all crest monuments |
| December 18 & 19 | Located crest monuments from control points. Completed level run. Work progressed very slowly due to strong winds. |
| January 8 | Travel to Ball Mountain Dam. Started locating crest monuments. |
| January 9 | Continued with survey work. Slow progress due to cold weather. Stopped work at noon due to high winds and cold temperatures. Four hours standby time. |
| January 10 | Completed survey and returned to Rockland, MA |

## SUMMARY OF ACTIVITIES

## BALL MOUNTAIN DAM - W.O. #24

| | |
|---|---|
| 13 Feb. 1985 | Mobilized to Ball Mountain. Started survey of crest monuments. |
| 14 Feb. 1985 | Continued surveying crest monuments Four hours standby due to snow squalls. |
| 15 Feb. 1985 | Finished survey at 1200 hours and returned to Rockland office. |
| 11 March 1985 | Mobilized to Ball Mountain. Started survey of crest monuments |
| 12 March 1985 | Standby 8 hours due to rain storm. |
| 13 March 1985 | Completed survey and returned to Rockland office. |
| 3 April 1985 | Mobilized to Ball Mountain Dam and started crest monument survey. |
| 4 April 1985 | Completed survey and returned to Rockland office. |
| 22 April 1985 | Mobilized to Ball Mountain Dam started crest monument survey |
| 23 April 1985 | Completed survey and returned to Rockland, MA |

TABLE 2 SUMMARY OF HORIZONTAL AND VERTICAL MOVEMENTS

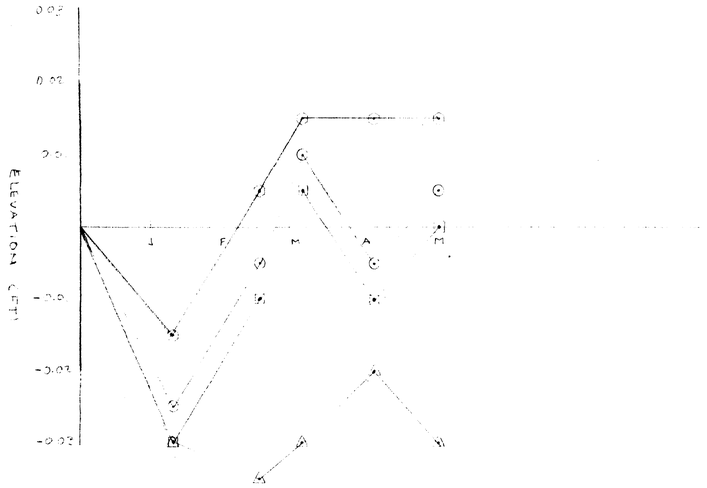
| | T1 | | | T2 | | | T3 | | |
|---|---|---|---|---|---|---|---|---|---|
| | H | | V | H | | V | H | | V |
| | NORTH | EAST | | NORTH | EAST | | NORTH | EAST | |
| January 10<br>2 | 0.005 | +.006 | -0.03 | -0.009 | +0.002 | -0.03 | +0.0044 | +0.007 | -0.025 |
| February 15<br>3 | -0.003 | -0.001 | -0.035 | -0.004 | +0.003 | -0.01 | +0.0123 | +0.008 | -0.005 |
| March 14<br>4 | -0.003 | -0.015 | -0.03 | -0.015 | +0.01 | +0.005 | +0.0105 | +0.014 | +0.01 |
| April 4<br>5 | -0.004 | +0.004 | -0.02 | -0.01 | +0.012 | -0.01 | +0.0042 | +0.019 | -0.005 |
| April 23<br>6 | +0.008 | +0.008 | -0.03 | -0.0007 | +0.02 | 0.00 | +0.0182 | +0.033 | +0.005 |
| | | | | | | | | | |
| | | | | | | | | | |

| | T4 | | | T5 | | | T6 | | |
|---|---|---|---|---|---|---|---|---|---|
| | H | | V | H | | V | H | | V |
| | NORTH | EAST | | NORTH | EAST | | NORTH | EAST | |
| January 10<br>2 | -0.0067 | -0.0054 | -0.015 | 0 | -0.0013 | +0.025 | -0.006 | 0 | +0.01 |
| February 15<br>3 | -0.0007 | -0.0002 | +0.005 | 0.01 | -0.006 | +0.01 | -0.006 | 0.011 | +0.015 |
| March 14<br>4 | +0.012 | -0.0129 | +0.015 | 0 | -0.0025 | +0.0025 | -0.0096 | -0.004 | +0.022 |
| April 4<br>5 | 0.0148 | -0.0126 | +0.015 | -0.014 | 0.015 | +0.005 | -0.022 | +0.0128 | +0.015 |
| April 23<br>6 | 0.0098 | -0.0091 | +0.015 | 0.0172 | 0.0105 | +0.005 | -0.006 | +0.014 | +0.025 |
| | | | | | | | | | |
| | | | | | | | | | |

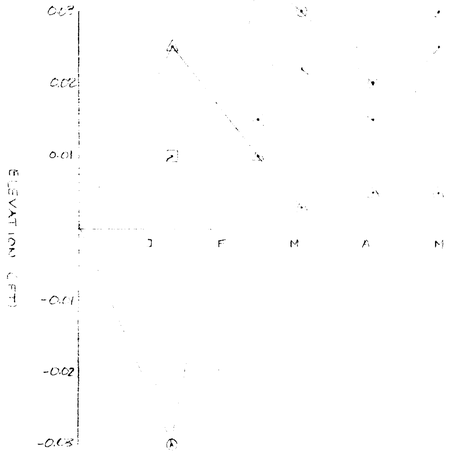
| | T7 | | | T8 | | | |
|---|---|---|---|---|---|---|---|
| | H | | V | H | | V | |
| | NORTH | EAST | | NORTH | EAST | | |
| January 10<br>2 | 0.022 | -0.009 | -0.015 | -0.0108 | +0.0115 | -0.02 | |
| February 15<br>3 | 0.005 | -0.001 | -0.015 | +0.0002 | -0.014 | -0.02 | |
| March 14<br>4 | 0.0034 | -0.007 | -0.008 | -0.008 | -0.0003 | -0.015 | |
| April 4<br>5 | -0.024 | +0.001 | -0.005 | -0.020 | 0.009 | -0.02 | |
| April 23<br>6 | +0.012 | +0.014 | -0.005 | -0.020 | 0.019 | -0.06 | |
| | | | | | | | |
| | | | | | | | |

| | STA (G) | | | STA (F) | | | |
|---|---|---|---|---|---|---|---|
| | NORTH | EAST | VERTICAL | NORTH | EAST | VERTICAL | |
| January 10<br>2 | 0.0333 | -0.10 | +0.005 | 0.005 | -0.006 | -0.03 | |
| February 15<br>3 | 0.0197 | 0.015 | -0.005 | -0.003 | -0.001 | +0.035 | |
| March 14<br>4 | 0.387 | -0.012 | +0.0125 | -0.002 | -0.014 | +0.03 | |
| April 4<br>5 | 0.0020 | 0.014 | +0.003 | -0.004 | 0.004 | +0.02 | |
| April 23<br>6 | 0.0351 | 0.010 | +0.02 | 0.008 | 0.008 | +0.03 | |
| | | | | | | | |
| | | | | | | | |

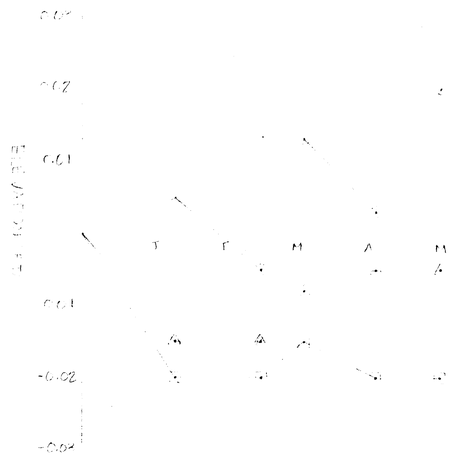
VERTICAL T1 T2 T3 T4



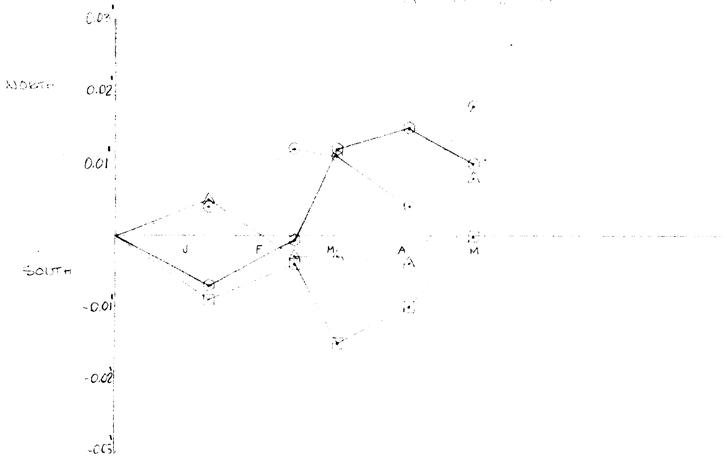

VERTICAL T5 T6 STAF



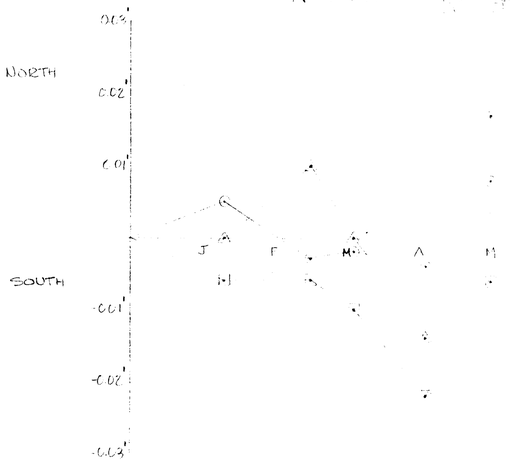

VERTICAL T7 T8 STAG



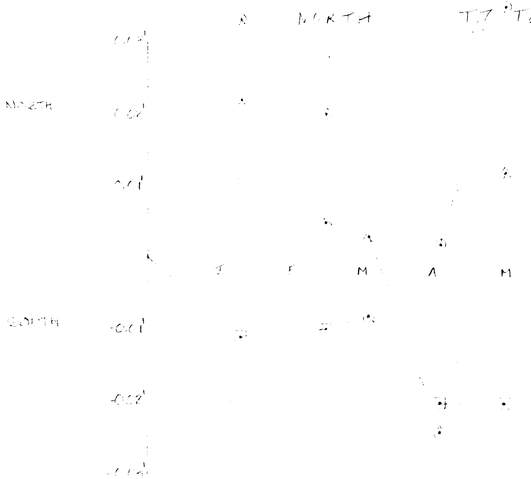

NORTH T1 T2 T3 T4



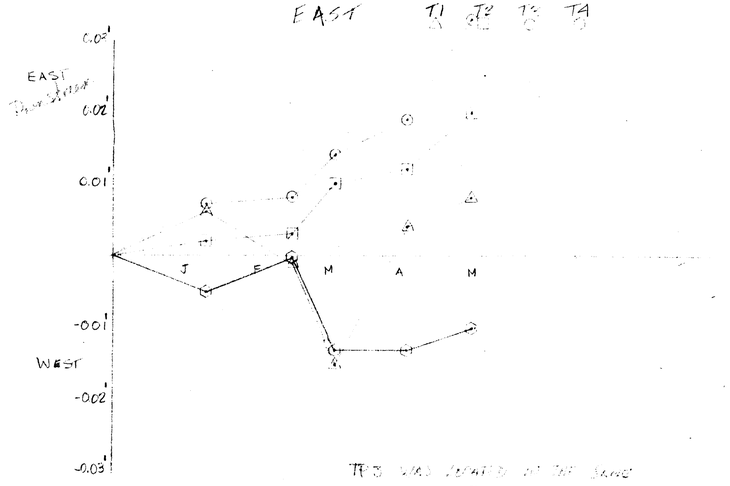

NORTH T5 T6 STAF




NORTH T7 T8 STAG

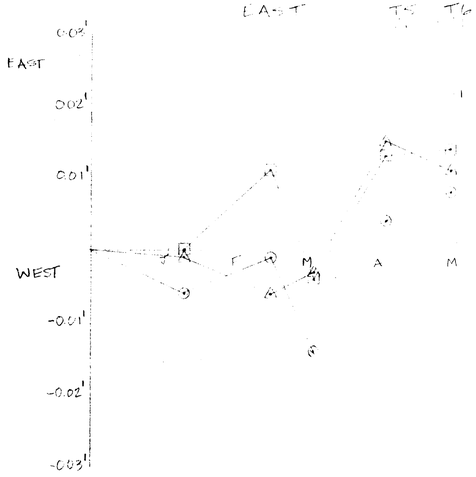



EAST T1 T2 T3 T4




T3 WAS LOCATED ON THE SAME
AXIS AS T4

EAST T5 T6 STAF




EAST T7 T8 STAG

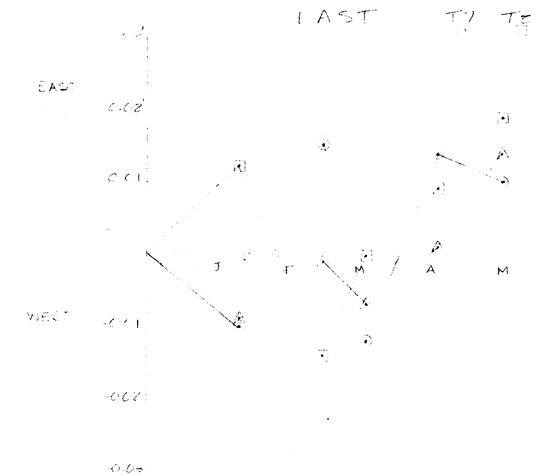



FIGURE 2
DEFORMATION MEASUREMENTS

FALL MT. DAM
MAY 10, 1985
PLOTTED BY EP
CHECKED BY MHL
FIELD BOOK FC 502

# APPENDIX A

## Installation and Survey Instructions

ATTACHMENT NO. 1

GEB REQUISITION NO. 85-22, DACW 33-83-D-0006

DELIVERY ORDER NO. 0024

INSPECTION, INSTALLATION AND SURVEY INSTRUCTIONS

PROJECT: Crest Survey Monumentation, Phase 1

SITE: Ball Mountain Dam, Jamaica, VT, Proj. Mgr. Ralph Snow (802)874-4881

PURPOSE: The purpose of this Delivery Order is to install crest survey monuments. The survey monuments will be used to monitor horizontal and vertical movement of existing dam embankment.

1. SCOPE OF INVESTIGATION.

a. Installations include eight (8) crest monuments. Three (3) shall be driven five (5) feet and five shall be driven seven (7) feet.

b. The crest monument locations shall be staked in the field by the government prior to drilling.

c. One five foot length of NX size casing shall be driven flush with ground surface at locations T-1, T-5 and T-7 as shown on Attachment 2. One five foot length plus one two-foot length of NX size casing shall be driven flush with ground surface at all other locations. The installed casing shall be cleaned out and backfilled with concrete sand. The casing shall then be sealed with a threaded cap and tightened by wrench to prevent vandalism.

d. The location of the crest monuments may be moved up to three feet if refusal is encountered prior to required depth.

e. The installed crest monuments shall be located by EDM survey. Include in the field survey book the EDM type, model number and serial number used to perform the survey.

f. A total of six surveys will be made to monitor vertical and horizontal movements of the crest monuments (twice in December 1984 and once a month thereafter through April 1985). Levels will be run from monument B thru the crest suvey monuments on the dam (including old monuments G, F and A) with a return run from the monuments on the dam back into Monument B to check the closure of the run. (See Attachment 3) Closure tolerance should be no greater than 0.05'. Horizontal movements shall be monitored by setting up on Monument H, siting on B and recording the offset to each crest monument. The angle of the offset will be recorded and the resultant distance computed. A check will be made by setting up on Monument B, siting H and recording the angle and offset of each crest monument.

g. The Government shall supply a field survey book (FC-502) in which all field calculations are to be conducted. Also snow shoes are available from the Ball Mountain Project Manager, if needed, for access during the periodic survey readings.

h. No geotechnical inspector will be required for this work effort. The driller shall provide telephone reports to Mr. Blair, Corps of Engineers, at 617-647-8396 every morning before the start of work.

2. SITE CONDITIONS

The proposed installation program is at Ball Mountain Dam, Jamaica, Vt. The location of the survey monuments is along the crest of the dam. During winter conditions, the dam is subject to high winds. Significant snow does not accumulate on top of the dam, but the access road leading to the crest does get snowed in. Access to perform surveys during the winter months might be limited, and snow shoes might be required.

Anticipated materials to be encountered at the crest locations of the dam include a two foot layer of gravel fill then either continued gravel fill on the downstream side or impervious fill. Stone sizes up to 10 inches may be encountered during monument installation. A general plan, Embankment Sections and Embankment Specifications is included in Attachment 4.

3. RIGHTS OF ENTRY.

The contractor is responsible for coordinating all work efforts with the project manager at Ball Mountain dam site, Mr. Ralph W. Snow, (802) 874-4881.

4. COORDINATION.

Mr. James Blair, Corps of Engineers, 617-647-8396, shall be contacted two days prior to the start of work and every workday by the driller to report on how work is progressing. The survey crews shall also contact Mr. Blair prior to the start of each periodic survey. Also, all standby time by either crew must be pre-approved by Mr. Blair or designated Government representative to be compensated to the Government.

5. MONUMENT NUMBERS.

The crest monuments shall be numbered in consecutive order as follows: Mon. #T1.

6. GOVERNMENT REVIEW.

The Government will review the draft geotechnical report submittal as well as the completed report. Subsequent to such review, the Contractor shall accomplish any corrections which may be directed as the result of the Government review.

7. COMPLETION SCHEDULE.

Services under this delivery order shall start within 15 days after receipt of delivery order. Duration of installation field work and location survey is estimated to be 10 days. A summary of activities including daily record of field activity ( monument drilling procedure and depth, standby/on site moves) shall be submitted no later than seven calendar days after the completion of the field work. Copies of the survey data and calculations will also be provided to the Government seven calendar days after each survey. When all installation and survey work is complete, the survey field book will be provided to the Government.

8. QUALITY CONTROL.

You will be held responsible for the quality of the maps submitted and for all damages caused the Government as a result of your negligence in the performance of any services furnished under the contract.

Although submissions required by your contract are technically reviewed by the Government, it is emphasized that your work must be prosecuted using proper internal controls and review procedures. The letter of transmittal for each submission which you make shall include a certification that the submission has been subjected to your own review and coordination procedures to insure (a) completeness for each discipline commensurate with the level of effort required for that submission, (b) elimination of conflicts, errors and omissions, and (c) the overall professional and technical accuracy of the submission. Documents which are significantly deficient in any of these areas will be returned to you for correction and/or upgrading prior to our completing our review. Contract submission dates will not be extended if a resubmission of draft material is required for this reason.

# APPENDIX B

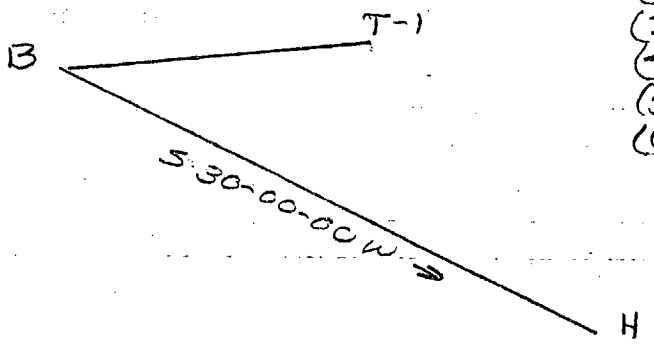
## Computation and Summary of Field Notes

BRIGGS

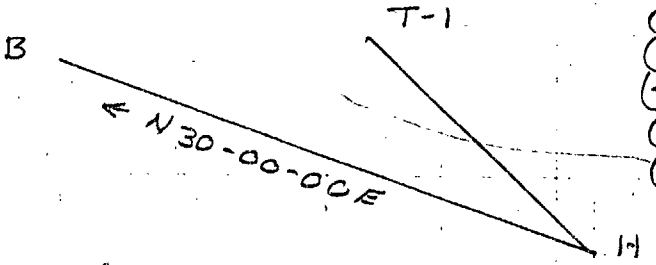
Project #

Preparer/Date 12-24-64 | Reviewer/Date | SHEET 1 of 10

Subject BALL MOUNTAIN DAM STA (T-1)




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | H-B-T-1 | S 8-46-18 W | 727.228 | 9281.2778 | 9889.1016 |
| (2) | H-B-T-1 | S 8-46-15W | 727.248 | 9281.263 | 9889.1071 |
| (3) | H-B-T-1 | S 8-46-15W | 727.237 | 9281.267 | 9889.1088 |
| (4) | H-B-T-1 | S 8-46-20W | 727.24 | 9281.267 | 9889.0909 |
| (5) | H-B-T-1 | S8-46-16 W | 727.23 | 9281.275 | 9889.1047 |
| (6) | H-B-T-1 | S8-48-15 W | 727.225 | 9281.279 | 9889.1107 |




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | B-H-T-1 | N 54-26-30 E | 636.359 | 9281.2997 | 9889.0956 |
| (2) | B-H-T-1 | N 54-26-20 E | 636359 | 9281.3249 | 9889.0779 |
| (3) | B-H-T-1 | N 54-26-27 E | 636.355 | 9281.3044 | 9889.0864 |
| (4) | B-H-T-1 | N 54-26-27 E | 636.344 | 9281.2982 | 9889.0777 |
| (5) | B-H-T-1 | N 54-26-32 E | 636.359 | 9281.2948 | 9889.0995 |
| (6) | B-H-T-1 | N 54-26-27 E | 636.374 | 9281.3145 | 9889.1032 |

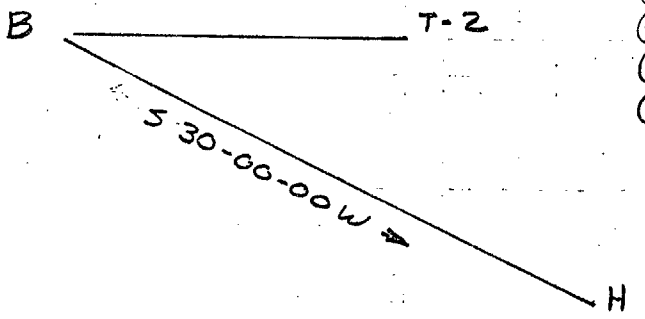
ELEV #1 (A) 94.48
(B) 94.48
#2 (A) 94.45
(B) 94.45
#3 (A) 94.52
(B) 94.51
#4 (A) 94.51
(B) 94.51
#5 (A) 94.50
(B) 94.50
#6 (A) 94.51
(B) 94.51

| AV | NORTH | EAST | DIFF N | DIFF E |
|---|---|---|---|---|
| (1) | 9281.2888 | 9889.0986 | .0219 | .006 |
| (2) | 9281.294 | 9889.0925 | .0619 | .029 |
| (3) | 9281.2857 | 9889.0976 | .0374 | .022 |
| (4) | 9281.2862 | 9889.0843 | .0312 | .013 |
| (5) | 9281.2849 | 9889.1021 | .0198 | .005 |
| (6) | 9281.297 | 9889.1069 | .0355 | .0075 |

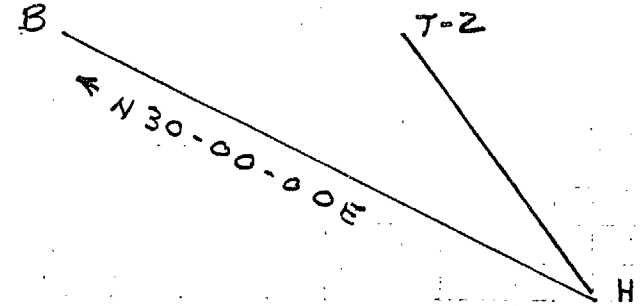
BRIGGS

Project # | Preparer/Date 12-24-84 | Reviewer/Date | SHEET 2 of 10

Subject BALL MOUNTAIN DAM STA T-2




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | H-B-T-2 | S 8-38-53W | 762.338 | 9246.3291 | 9885.3782 |
| (2) | H-B-T-2 | S 8-38-55W | 762.36 | 9246.3082 | 9885.3607 |
| (3) | H-B-T-2 | S 8-38-50W | 762.35 | 9246.3114 | 9885.3799 |
| (4) | H-B-T-2 | S 8-38-50W | 762.35 | 9246.3141 | 9885.3803 |
| (5) | H-B-T-2 | S 8-38-50W | 762.349 | 9246.3172 | 9885.3789 |
| (6) | H-B-T-2 | S 8-38-47W | 762.34 | 9296.324 | 9885.3912 |




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | B-H-T-2 | N56-53-43E | 613.565 | 9246.3479 | 9885.3691 |
| (2) | B-H-T-2 | N 56-53-45 E | 613.579 | 9246.3499 | 9885.3859 |
| (3) | B-H-T-2 | N 56-53-40 E | 613.569 | 9246.3580 | 9885.3684 |
| (4) | B-H-T-2 | N 56-53-50E | 613.568 | 9246.3327 | 9885.3839 |
| (5) | B-H-T2 | N 56-53-48 5E | 613.575 | 9246.3397 | 9885.3866 |
| (6) | B-H-T2 | N 56-53-46 E | 613.525 | 9246.3516 | 9885.3911 |

ELEV #1 (A) 94.66
(B) 94.66
#2 (A) 94.63
(B) 94.63
#3 (A) 94.65
(B) 94.64
#4 (A) 94.665
(B) 94.665
#5 (A) 94.66
(B) 94.65
#6 (A) 94.66
(B) 94.66

| AV | NORTH | EAST | DIFF N | DIFF E |
|---|---|---|---|---|
| (1) | 9246.3385 | 9885.3712 | .018 | .0041 |
| (2) | 9246.3291 | 9885.3733 | .04 | .0252 |
| (3) | 9246.3347 | 9885.3742 | .046 | .0115 |
| (4) | 9246.3234 | 9885.3821 | .018 | .0036 |
| (5) | 9246.3284 | 9885.3828 | .022 | .0077 |
| (6) | 9246.3378 | 9885.3912 | .028 | .0001 |

BRIGGS

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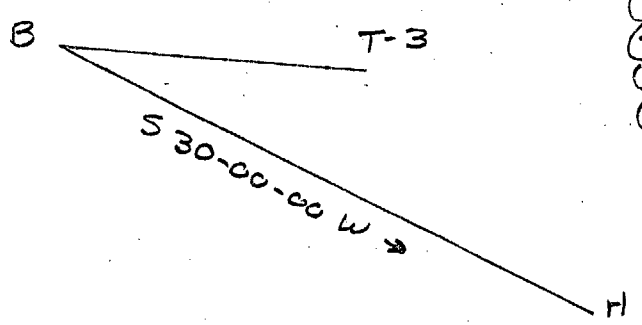
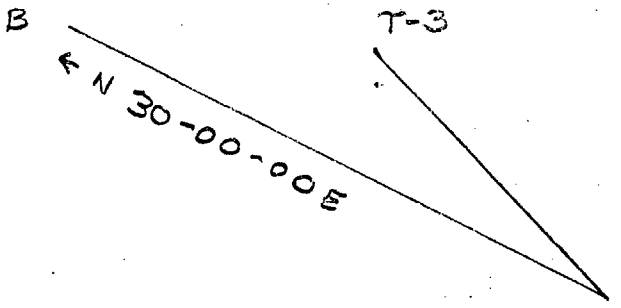
Subject BALL MOUNTAIN DAM STA T-3




| | STATION | BEARINGS | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | H-B-T-3 | S 9-43-13 W | 730.00 | 9280.4796 | 9876.7498 |
| (2) | H-B-T-3 | S 9-43-12 W | 730.00 | 9280.4783 | 9876.7514 |
| (3) | H-B-T-3 | S 9-43-05 W | 730.00 | 9280.4741 | 9876.7758 |
| (4) | H-B-T-3 | S 9-43-04 W | 729.99 | 9280.4817 | 9876.7806 |
| (5) | H-B-T-3 | S 9-43-04 W | 730.00 | 9280.4720 | 9876.7790 |
| (6) | H-B-T-3 | S 9-42-57 W | 729.98 | 9280.4885 | 9876.8052 |




| | STATION | BEARING | DIST | NORT | EAST |
|---|---|---|---|---|---|
| (1) | B-H-T-3 | N 53-50-50 E | 625.899 | 9280.48 | 9876.7827 |
| (2) | B-H-T-3 | N 53-50-50 E | 625.914 | 9280.49 | 9876.7949 |
| (3) | B-H-T-3 | N 53-50-40 E | 625.909 | 9280.51 | 9876.7723 |
| (4) | B-H-T-3 | N 53-50-43 E | 625.903 | 9280.499 | 9876.7734 |
| (5) | B-H-T3 | N 53-50-475 E | 625.915 | 9280.4954 | 9876.7908 |
| H (6) | B-H-T3 | N 53-50-45 | 625.925 | 9280.5074 | 9876.7949 |

ELEV #1 (A) 94.41
(B) 94.41
#2 (A) 94.39
(B) 94.38
#3 (A) 94.41
(B) 94.40
#4 (A) 94.42
(B) 94.42
#5 (A) 94.41
(B) 94.40
#6 (A) 94.41
(B) 94.42

| AV | NORTH | EAST | DIFF N | DIFF E |
|---|---|---|---|---|
| (1) | 9280.4798 | 9876.766 | .0009 | .0329 |
| (2) | 9280.4842 | 9876.773 | .01 | .0435 |
| (3) | 9280.4920 | 9876.7741 | .036 | .0035 |
| (4) | 9280.4903 | 9876.78 | .0173 | .0146 |
| (5) | 9280.484 | 9876.785 | .023 | .0118 |
| (6) | 9280.498 | 9876.799 | .0189 | .0108 |

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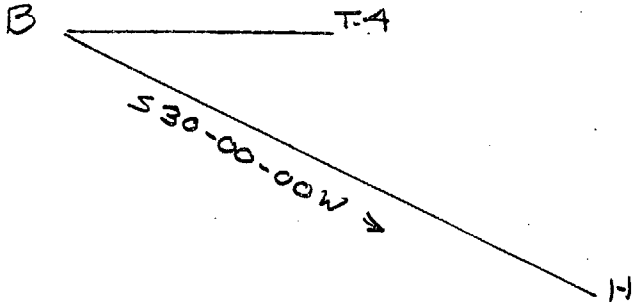
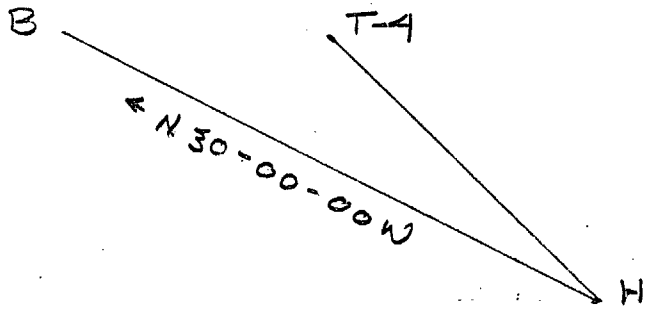
Subject BALL MOUNTAIN DAM STA T-4




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | H-B-T-4 | S 10-26-55W | 644.863 | 9365.8391 | 9883.0535 |
| (2) | H-B-T-4 | S 10-27-00W | 644.88 | 9365.8143 | 9883.0398 |
| (3) | H-B-T-4 | S 10-26-50W | 644.87 | 9365.823 | 9883.0664 |
| (4) | H-B-T-4 | S 10-26-57W | 644.87 | 9365.829 | 9883.0453 |
| (5) | H-B-T-4 | S 10-26-55W | 644.858 | 9365.835 | 9883.0526 |
| (6) | H-B-T-4 | S 10-26-50W | 644851 | 9365.839 | 9883.0693 |




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | B-H-T-4 | N 48-22-42E | 684.459 | 9365.8612 | 9883.0682 |
| (2) | B-H-T-4 | N 48-22-40E | 684.469 | 9365.8727 | 9883.0713 |
| (3) | B-H-T-4 | N 48-22-36E | 684.459 | 9365.8760 | 9883.055 |
| (4) | B-H-T-4 | N 48-22-31E | 684.469 | 9365.895 | 9883.051 |
| (5) | B-H-T-4 | N 48-22-29E | 684.465 | 9356.895 | 9883.049 |
| (6) | B-H-T-4 | N 48-22-38E | 684.477 | 9365.881 | 9883.0732 |

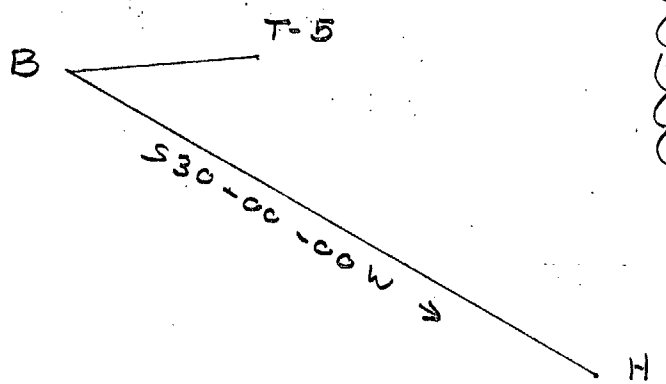
ELEV #1 (A) 95.31
(B) 95.31
#2 (A) 96.30
(B) 95.29
#3 (A) 95.31
(B) 95.32
#4 (A) 95 326
(B) 95.325
#5 (A) 95.33
(B) 95.32+
#6 (A) 95.32
(B) 95.33

| AV | NORTH | EAST | DIFF N | DIFF E |
|---|---|---|---|---|
| (1) | 9365.8502 | 9883.0609 | .022 | .015 |
| (2) | 9365.8435 | 98830556 | .058 | .032 |
| (3) | 9365.849 | 9883.0607 | .053 | .011 |
| (4) | 9365.862 | 9883.048 | .066 | .0057 |
| (5) | 9365.865 | 9883.0483 | .061 | .0086 |
| (6) | 9365.86 | 9883.07 | .042 | .0039 |

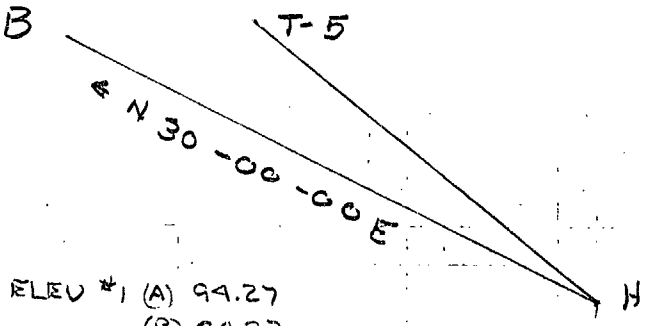
BRIGGS

Project # | Preparer/Date 12-24-84 | Reviewer/Date | SHEET 5 of 10

Subject BALL MOUNTAIN DAM STA T-5




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | H-B-T-5 | S 13-16-45 W | 399.316 | 9611.3611 | 9908.279 |
| (2) | H-B-T-5 | S 13-16-39 W | 399.33 | 9611.3432 | 9908.2865 |
| (3) | H-B-T-5 | S 13-16-35 W | 399.33 | 9611.346 | 9908.295 |
| (4) | H-B-T-5 | S 13-16-31 W | 399.33 | 9611.342 | 9908.302 |
| (5) | H-B-T5 | S 13-16-275 W | 399.324 | 9611.345 | 9908.310 |
| (6) | H-B-T5 | S 13-1635 W | 399.31 | 9611.3621 | 9908.299 |




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | B-H-T-5 | N 37-29-00 E | 882.29 | 9611.359 | 9908.302 |
| (2) | B-H-T-5 | N 37-28-55 E | 882.299 | 9611.381 | 9908.292 |
| (3) | B-H-T-5 | N 37-28-50 E | 882.299 | 9611.394 | 9908.274 |
| (4) | B-H-T-5 | N 37-28-53 E | 882.298 | 9611.385 | 9908.284 |
| (5) | B-H-T5 | N 37-29-01 E | 882.279 | 9611.348 | 9908.3010 |
| (6) | B-H-T5 | N 37-28-55 E | 882.315 | 9611.3922 | 9908.3027 |

ELEV #1 (A) 94.27
(B) 94.27
#2 (A) 94.25
(B) 94.24
#3 (A) 94.27
(B) 94.25
#4 (A) 94.27
(B) 94.275
#5 (A) 94.27
(B) 94.26
6 (A) 94.28
(B) 94.27

| AV | NORTH | EAST | Diff N | Diff E |
|---|---|---|---|---|
| (1) | 9611.36 | 9908.2905 | .002 | .023 |
| (2) | 9611.36 | 9908.2893 | .038 | .006 |
| (3) | 9611.37 | 9908.2845 | .048 | .021 |
| (4) | 9611.36 | 9908.293 | .043 | .018 |
| (5) | 9611.346 | 9908.305 | .003 | .009 |
| (6) | 9611.377 | 9908.301 | .03 | .0037 |

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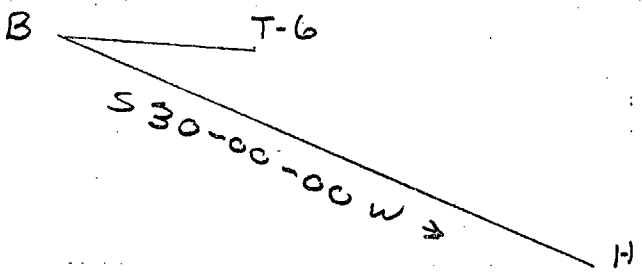
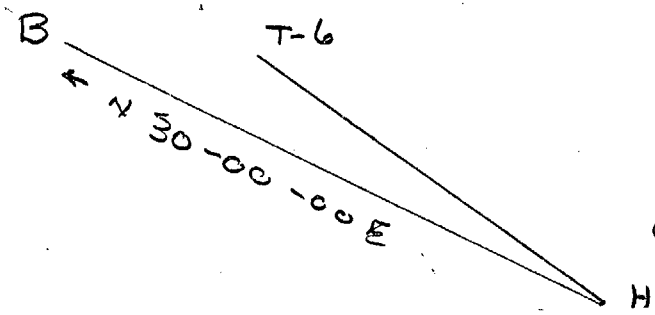
Subject BALL MOUNTAIN DAM STA T-6




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | H-B-T-6 | S14-19-31W | 398.349 | 9614.0421 | 9901.4382 |
| (2) | H-B-T-6 | S14-19-35W | 398.358 | 9614.0301 | 9901.4282 |
| (3) | H-B-T-6 | S14-19-24W | 398.352 | 9614.0305 | 9901.4502 |
| (4) | H-B-T-6 | S14-19-33W | 398.351 | 9614.0362 | 9901.4337 |
| (5) | H-B-T-6 | S14-19-26.5W | 398.343 | 9614.0411 | 9901.4479 |
| (6) | H-B-T-6 | S14-19-13W | 398.34 | 9614.0371 | 9901.4738 |




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | B-H-T-6 | N37-01-18E | 880.289 | 9614.067 | 9901.4397 |
| (2) | B-H-T-6 | N37-01-20E | 880.294 | 9614.066 | 9901.4496 |
| (3) | B-H-T-6 | N37-01-20E | 880.294 | 9614.066 | 9901.4495 |
| (4) | B-H-T-6 | N37-01-20 | 880.285 | 9614.058 | 9901.4434 |
| (5) | B-H-T6 | N37-01-27 | 880.265 | 9614.024 | 9901.4554 |
| (6) | B-H-T6 | N37-01-14 | 880.29 | 9614.0847 | 9901.4316 |

ELEV #1 (A) 95.13
(B) 95.19
#2 (A) 95.13
(B) 95.12
#3 (A) 95.15
(B) 95.13
#4 (A) 95.16
(B) 95.155
#5 (A) 95.14
(B) 95.16
#6 (A) 95.16
(B) 95.16

| AV | NORTH | EAST | Diff N | Diff E |
|---|---|---|---|---|
| (1) | 9614.0546 | 9901.4389 | .025 | .0015 |
| (2) | 9614.0481 | 9901.4389 | .063 | .0219 |
| (3) | 9614.048 | 9901.4498 | .036 | .0007 |
| (4) | 9614.045 | 9901.4355 | .016 | .009 |
| (5) | 9614.033 | 9901.4517 | .017 | .0075 |
| (6) | 9614.061 | 9901.4527 | .047 | .0422 |

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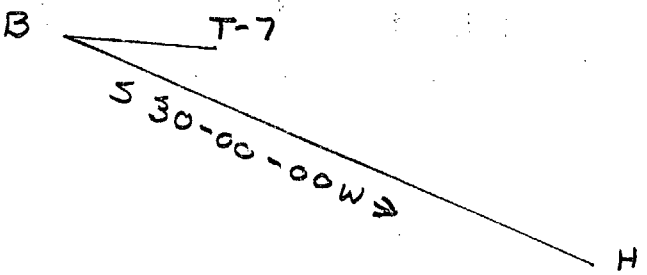
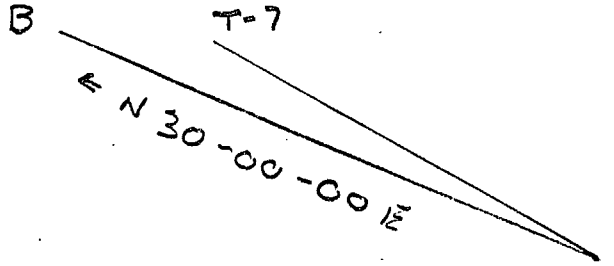
Subject BALL MOUNTAIN DAM STA T-7




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | H-B-T-7 | S16-38-37W | 263.53 | 9747.5132 | 9924.5211 |
| (2) | H-B-T-7 | S16-38-45W | 263.58 | 9747.5098 | 9924.5094 |
| (3) | H-B-T-7 | S16-38-31W | 263.528 | 9747.5099 | 9924.5281 |
| (4) | H-B-T-7 | S16-38-30W | 263.535 | 9747.5035 | 9924.5276 |
| (5) | H-B-T-7 | S16-38-39W | 263.631 | 9747.5105 | 9924.5170 |
| (6) | H-B-T-7 | S16-38-20W | 263.508 | 9747.5255 | 9924.5474 |




| | STATION | Bearing | Dist | North | East |
|---|---|---|---|---|---|
| (1) | B-H-T-7 | N33-28-49E | 1002.675 | 9747.5435 | 9924.5277 |
| (2) | B-H-T-7 | N33-28-47E | 1002.675 | 9747.5489 | 9924.5196 |
| (3) | B-H-T-7 | N33-28-46E | 1002.679 | 9747.5557 | 9924.5183 |
| (4) | B-H-T-7 | N33-28-45E | 1002.665 | 9747.5457 | 9924.5059 |
| (5) | B-H-T-7 | N33-28-56E | 1002.6399 | 9747.4983 | 9924.5328 |
| (6) | B-H-T-7 | N33-28-48E | 1002.6850 | 9747.5547 | 9924.5293 |

ELEV #1 (A) 95.04
(B) 95.05
#2 (A) 95.03
(B) 95.03
#3 (A) 95.04
(B) 95.02
#4 (A) 95.04
(B) 95.035
#5 (A) 95.03
(B) 95.05
#6 (A) 95.04
(B) 95.04

| AV | NORTH | EAST | DIFF N | DIFF E |
|---|---|---|---|---|
| (1) | 9747.528 | 9924.524 | .03 | .006 |
| (2) | 9747.5499 | 9924.515 | .039 | .010 |
| (3) | 9747.5328 | 9924.523 | .045 | .0098 |
| (4) | 9747.5246 | 9924.5167 | .042 | .022 |
| (5) | 9747.504 | 9924.525 | .012 | .0158 |
| (6) | 9747.54 | 9924.538 | .029 | .018 |

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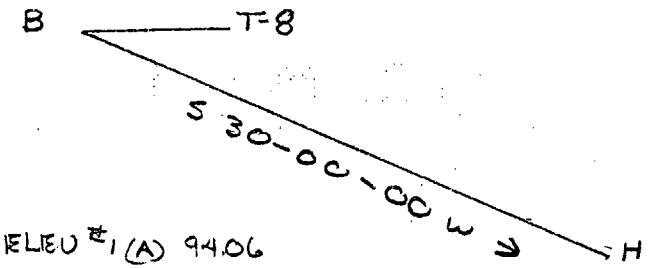
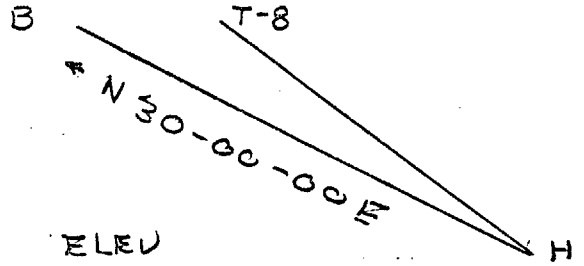
Subject BALL MOUNTAIN DAM STA T-8




ELEV #1 (A) 94.06
(B) 94.06
#2 (A) 94.04
(B) 94.04
#3 (A) 94.05
(B) 94.03
(4) (A) 94.05
(B) 94.04




ELEV
(5) A 94.05
B 94.03
(6) A 94.04
B 94.04

| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | H-B-T-8 | S 14-54-14 W | 258.269 | 9750.4192 | 9933.5736 |
| (2) | H-B-T-8 | S 14-54-16 W | 258.28 | 9750.4091 | 9933.5683 |
| (3) | H-B-T-8 | S 14-54-05 W | 258.27 | 9750.4114 | 9933.5831 |
| (4) | H-B-T-8 | S 14-54-02 W | 258.27 | 9750.4098 | 9933.5866 |
| (5) | H-B-T-8 | S 14-54-08 W | 258.276 | 9750.4102 | 9933.5789 |
| (6) | H-B-T-8 | S 14-53-56 W | 258.253 | 9750.429 | 9933.6008 |

| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | B-H-T-8 | N 33-49-03 E | 1010.11 | 9750.4537 | 9933.5803 |
| (2) | B-H-T-8 | N 33-49-09 E | 1010.119 | 9750.4422 | 9933.6079 |
| (3) | B-H-T-8 | N 33-49-00 E | 1010.113 | 9750.4618 | 9933.5681 |
| (4) | B-H-T-8 | N 33-49-00 E | 1010.113 | 9750.4617 | 9933.5679 |
| (5) | B-H-T-8 | N 33-49-08 E | 1010.094 | 9750.4223 | 9933.5917 |
| (6) | B-H-T-8 | N 33-49-015 E | 1010.194 | 9750.4831 | 9933.5912 |

| AV | NORTH | EAST | DIFF N | DIFF E |
|---|---|---|---|---|
| (1) | 9750.43695 | 9933.57695 | .03 | .0067 |
| (2) | 9750.4257 | 9933.5881 | .033 | .0396 |
| (3) | 9750.4366 | 9933.5756 | .05 | .015 |
| (4) | 9750.4357 | 9933.5772 | .05 | .019 |
| (5) | 9750.416 | 9933.585 | .012 | .013 |
| (6) | 9750.456 | 9933.596 | .054 | .0096 |

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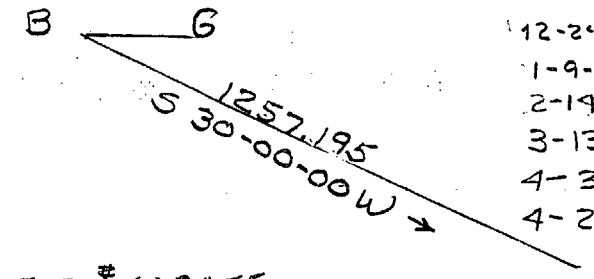
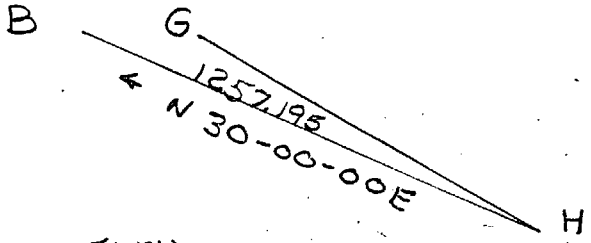
Subject BALL MOUNTAIN DAM STA (G)




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| 12-24-84 (1) | H-B-G | S16-17-52W | 237.98 | 9771.5799 | 9933.2149 |
| 1-9-85 (2) | H-B-G | S16-18-05W | 237.95 | 9771.6134 | 9933.2091 |
| 2-19-85 (3) | H-B-G | S16-17-50W | 237.95 | 9771.6085 | 9933.2257 |
| 3-13-85 (4) | H-B-G | S16-17-56W | 237.94 | 9771625 | 9933.2232 |
| 4-3-85 (5) | H-B-G | S16-17-45W | 237.95 | 9771.609 | 9933.232 |
| 4-22-85 6 | H-B-G | S16-17-425 | 237.936 | 9771.622 | 9933.239 |

ELEV #1 (A) 94.55
(B) 94.56
#2 (A) 94.56
(B) 94.56
#3 (A) 94.56
(B) 94.54
#4 (A) 94 57
(B) 94.565
#5 (A) 94.59
(B) 94.57




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | B-H-G | N33-08-39E | 1027.56 | 9771.6099 | 9933.21795 |
| (2) | B-H-G | N33-08-33E | 1027.58 | 9771.6430 | 9933.20397 |
| (3) | B-H-G | N33-08-41E | 1027.579 | 9771.6208 | 9933.2377 |
| (4) | B-H-G | N33-08-30E | 1027.57 | 9771.6423 | 9933.1856 |
| (5) | B-H-G | N33-08-43E | 1027.54 | 9771.5848 | 9933.2284 |
| (6) | B-H-G | N33-08-35E | 1027.58 | 9771.6378 | 9933.2124 |

ELEV
#6 (A) 94.57
(B) 94.58

| AV | NORTH | EAST | DIFF N | DIFF E |
|---|---|---|---|---|
| (1) | 9771.5949 | 9933.216 | .03 | .003 |
| (2) | 9771.6282 | 9933.206 | .0296 | .005 |
| (3) | 9771.6146 | 9933.231 | .012 | .011 |
| (4) | 9771.6336 | 9933.204 | .017 | .037 |
| (5) | 9771.5969 | 9933.23 | .024 | .004 |
| (6) | 9971.63 | 9933.226 | .016 | .02 |

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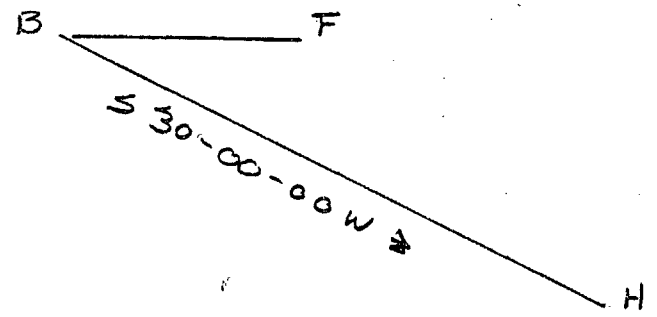
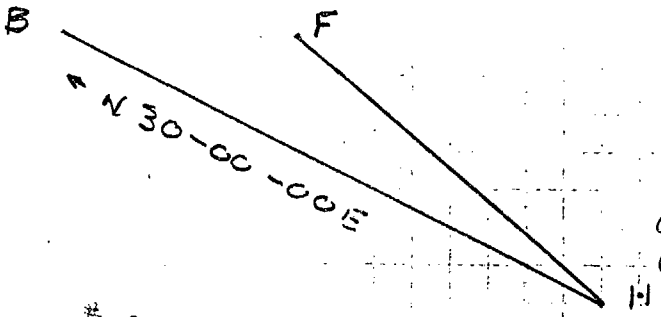
Subject BALL MOUNTAIN DAM STA (F)




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | H-B-F | S 12-53-41W | 457.04 | 9554.4826 | 9898.0072 |
| (2) | H-B-F | S 12-53-39W | 457.059 | 9554.4659 | 9898.0068 |
| (3) | H-B-F | S 12-53-40W | 457.05 | 9554.4749 | 9898.0066 |
| (4) | H-B-F | S 12-53-35W | 457.05 | 9554.4732 | 9898.0176 |
| (5) | H-B-F | S 12-53-335W | 457.05 | 9554.4722 | 9898.0208 |
| (6) | H-B-F | S 12-53-275W | 457.06 | 9554.4596 | 9898.0315 |




| | STATION | BEARING | DIST | NORTH | EAST |
|---|---|---|---|---|---|
| (1) | B-H-F | N 39-18-25 E | 831.329 | 9554.4893 | 9898.0285 |
| (2) | B-H-F | N 39-18-15 E | 831.339 | 9554.5227 | 9898.0038 |
| (3) | B-H-F | N 39-18-15 E | 831.339 | 9554.5226 | 9898.0038 |
| (4) | B-H-F | N 39-18-19 E | 831.329 | 9554.5044 | 9898.0097 |
| (5) | B-H-F | N 39-18-15 E | 831.329 | 9554.5145 | 9897.9971 |
| (6) | B-H-F | N 39-18-16 E | 831.347 | 9554.5256 | 9898.0119 |

ELEV #1 (A) 94.83
(B) 94.89
#2 (A) 94.84
(B) 94.84
(3) (A) 94.89
(B) 94.88
(4) (A) 94.91
(B) 94.90
(5) (A) 9489
(B) 94.89
(6) (A) 9489
(B) 94.90

| AV | NORTH | EAST | Diff N | Diff E |
|---|---|---|---|---|
| (1) | 9554.486 | 9898.0179 | .0067 | .0213 |
| (2) | 9554.494 | 9898.0053 | .057 | .003 |
| (3) | 9554.499 | 9898.0052 | .0477 | .0028 |
| (4) | 9554.489 | 9898.0137 | .03 | .0079 |
| (5) | 9554.493 | 9898.009 | .04 | .02 |
| (6) | 9554.493 | 9898.02 | .06 | .02 |

# APPENDIX C

## Safety Reports

EASTERN GEOTECHNICAL ASSOCIATES

WEEKLY SAFETY MEETING

TO: Safety Office, NED

FROM: Field Engineer
THRU: Project Engineer

Date held 10 December 1984
Time 07:00

Weekly safety meeting was held this date for the following personnel:
Contract No. DACW 33-83-D-0006, W. O. No. 24

Personnel present:
Robert Smith
Edgar Packard
Michael Ganley

Conducted By: N. Lanney

1. Subjects discussed Note, delete, or add):

X Individual Protective Equipment - Ear protection, hard hats
X Prevention of Falls -
Safe Lifting Techniques -
Emergency Communications -
Fire Prevention -
Sanitation, First Aid -
Tripping Hazards - trash, hose, nails in lumber -
Staging, Ladders, Concrete Forms -
Hand Tools -
Portable Power Tools -
Woodworking Machinery -
Equipment Maintenance Zero defects) -
Hoisting Equipment -
Ropes, Hooks, Chains and Slings -
Electrical Grounding, Temporary Wiring -
Lockouts for safe clearance procedures -
Electrical, pressure, moving parts -
Welding -
Excavations -
Loose Rock and Steep Slopes -
Explosives -
Water Safety -
Other -

Prepared by: N. Lanney
Field Engineer

2. Exposure:

For the week ending December 14, 3 men at 16 hours, for a total of 48 manhours.

Signature: Nicholas A. Lanney
Project Engineer

3. Forwarded: NED, Waltham, MA

EASTERN GEOTECHNICAL ASSOCIATES

WEEKLY SAFETY MEETING

TO: Safety Office, NED

FROM: Field Engineer
THRU: Project Engineer

Date held 7 January 1985
Time 07:00

Weekly safety meeting was held this date for the following personnel:
Contract No. DACW 33-83-D-0006, W. O. No. 24

Personnel present:
Robert Smith
Edgar Pakcard
Robert Page

Conducted By: N. Lanney

1. Subjects discussed Note, delete, or add):

X Individual Protective Equipment - Ear protection, hard hats
X Prevention of Falls -
Safe Lifting Techniques -
Emergency Communications -
Fire Prevention -
Sanitation, First Aid -
Tripping Hazards - trash, hose, nails in lumber -
Staging, Ladders, Concrete Forms -
Hand Tools -
Portable Power Tools -
Woodworking Machinery -
Equipment Maintenance Zero defects) -
Hoisting Equipment -
Ropes, Hooks, Chains and Slings -
Electrical Grounding, Temporary Wiring -
Lockouts for safe clearance procedures -
Electrical, pressure, moving parts -
Welding -
Excavations -
Loose Rock and Steep Slopes -
Explosives -
Water Safety -
Other -

Prepared by: N. Lanney
Field Engineer

2. Exposure:

For the week ending January 12, 3 men at 16 hours, for a total of 48 manhours.

Signature: Nicholas O. Lanney
Project Engineer

3. Forwarded: NED, Waltham, MA

EASTERN GEOTECHNICAL ASSOCIATES

WEEKLY SAFETY MEETING

TO: Safety Office, NED

FROM: Field Engineer
THRU: Project Engineer

Date held 12 February 1985
Time 07:00

Weekly safety meeting was held this date for the following personnel:
Contract No. DACW 33-83-D-0006, W. O. No. 24

Personnel present:
Robert Smith
Robert Page
Edgar Packard

Conducted By: N. Lanney

1. Subjects discussed Note, delete, or add):

XIndividual Protective Equipment - Ear protection, hard hats
XPrevention of Falls -
Safe Lifting Techniques -
Emergency Communications -
Fire Prevention -
Sanitation, First Aid -
Tripping Hazards - trash, hose, nails in lumber -
Staging, Ladders, Concrete Forms -
Hand Tools -
Portable Power Tools -
Woodworking Machinery -
Equipment Maintenance Zero defects) -
Hoisting Equipment -
Ropes, Hooks, Chains and Slings -
Electrical Grounding, Temporary Wiring -
Lockouts for safe clearance procedures -
Electrical, pressure, moving parts -
Welding -
Excavations -
Loose Rock and Steep Slopes -
Explosives -
Water Safety -
Other -

Prepared by: N. Lanney
Field Engineer

2. Exposure:

For the week ending February 16, 3 men at 16 hours for a total of 48 manhours

Signature: Nicholas O. Lanney
Project Engineer

3. Forwarded: NED, Waltham, MA

EASTERN GEOTECHNICAL ASSOCIATES

WEEKLY SAFETY MEETING

TO: Safety Office, NED

FROM: Field Engineer
THRU: Project Engineer

Date held 11 March 1985
Time 07:00

Weekly safety meeting was held this date for the following personnel:
Contract No. DACW 33-83-D-0006, W. O. No.24

Personnel present:
Robert Smith
Robert Page
Edgar Packard

Conducted By: N. Lanney

1. Subjects discussed Note, delete, or add):

X Individual Protective Equipment - Ear protection, hard hats
X Prevention of Falls -
Safe Lifting Techniques -
Emergency Communications -
Fire Prevention -
Sanitation, First Aid -
Tripping Hazards - trash, hose, nails in lumber -
Staging, Ladders, Concrete Forms -
Hand Tools -
Portable Power Tools -
Woodworking Machinery -
Equipment Maintenance Zero defects) -
Hoisting Equipment -
Ropes, Hooks, Chains and Slings -
Electrical Grounding, Temporary Wiring -
Lockouts for safe clearance procedures -
Electrical, pressure, moving parts -
Welding -
Excavations -
Loose Rock and Steep Slopes -
Explosives -
Water Safety -
Other -

Prepared by: N. Lanney
Field Engineer

2. Exposure:

For the week ending March 16, 3 men at 12 hours, for a total of 36 manhours.

Signature: Nicholas O. Lanney
Project Engineer

3. Forwarded: NED, Waltham, MA

EASTERN GEOTECHNICAL ASSOCIATES

WEEKLY SAFETY MEETING

TO: Safety Office, NED

FROM: Field Engineer
THRU: Project Engineer

Date held 2 April 1985
Time 08:00

Weekly safety meeting was held this date for the following personnel:
Contract No. DACW 33-83-D-0006, W. O. No. 24

Personnel present:
Robert Smith
Edgar Packard
Robert Page

Conducted By: N. Lanney

1. Subjects discussed Note, delete, or add):

X Individual Protective Equipment - Ear protection, hard hats
X Prevention of Falls -
Safe Lifting Techniques -
Emergency Communications -
Fire Prevention -
Sanitation, First Aid -
Tripping Hazards - trash, hose, nails in lumber -
Staging, Ladders, Concrete Forms -
Hand Tools -
Portable Power Tools -
Woodworking Machinery -
Equipment Maintenance Zero defects) -
Hoisting Equipment -
Ropes, Hooks, Chains and Slings -
Electrical Grounding, Temporary Wiring -
Lockouts for safe clearance procedures -
Electrical, pressure, moving parts -
Welding -
Excavations -
Loose Rock and Steep Slopes -
Explosives -
Water Safety -
Other -

Prepared by: Nick Lanney
Field Engineer

2. Exposure:

For the week ending April 7, 3 men at 16 hours, for a total of 48 manhours

Signature: Nick O. Lanney
Project Engineer

3. Forwarded: NED, Waltham, MA

EASTERN GEOTECHNICAL ASSOCIATES

WEEKLY SAFETY MEETING

TO: Safety Office, NED

FROM: Field Engineer
THRU: Project Engineer

Date held 22 April 1985
Time 07:00

Weekly safety meeting was held this date for the following personnel:
Contract No. DACW 33-83-D-0006, W. O. No. 24

Personnel present:
Robert Smith
Edgar Packard
L. Robert Page

Conducted By: N. Lanney

1. Subjects discussed Note, delete, or add):

X Individual Protective Equipment - Ear protection, hard hats
X Prevention of Falls -
Safe Lifting Techniques -
Emergency Communications -
Fire Prevention -
Sanitation, First Aid -
Tripping Hazards - trash, hose, nails in lumber -
Staging, Ladders, Concrete Forms -
Hand Tools -
Portable Power Tools -
Woodworking Machinery -
Equipment Maintenance Zero defects) -
Hoisting Equipment -
Ropes, Hooks, Chains and Slings -
Electrical Grounding, Temporary Wiring -
Lockouts for safe clearance procedures -
Electrical, pressure, moving parts -
Welding -
Excavations -
Loose Rock and Steep Slopes -
Explosives -
Water Safety -
Other -

Prepared by: Nick Lanney
Field Engineer

2. Exposure:

For the week ending April 23, 3 men at 16 hours, for a total of 48 manhours

Signature: _____
Project Engineer

3. Forwarded: NED, Waltham, MA